DECLARATION

ATLAS TACK CORP. SUPERFUND SITE

Fairhaven, Massachusetts

(CERCLIS Number MAD001026319)

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for the Atlas Tack Corp. Superfund Site, in Fairhaven, Massachusetts, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the Administrative Record file for this Site.

This decision is based on the Administrative Record which has been developed in accordance with Section 113(k) of CERCLA and which is available for public review at the Millicent Public Library in Fairhaven, Massachusetts and at the US EPA - Region I Office of Site Remediation and Restoration Records Center in Boston, Massachusetts. The Administrative Record Index identifies each of the items comprising the Administrative Record and is included as Appendix B of the Record of Decision (ROD).

The Commonwealth of Massachusetts concurs with the Selected Remedy.

ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF THE SELECTED REMEDY

The Selected Remedy consists of the following activities:

- Site Setup, Clearing, Sampling, and Contamination Delineation - The first step in the remedial process will be to establish an on-site office and mobile laboratory to support the field activities. After field facilities are set up, the soils and sediments will be sampled to better define the remediation areas and amounts. A bioavailability study in the Marsh Area will be performed to better define the extent of the areas requiring excavation, thereby avoiding, to the extent practicable, the unnecessary destruction of any floodplain, wetland

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or riverfront area. A treatability study will be performed to determine the most appropriate treatment for the contaminated materials that can and need to be treated. Debris and vegetation will be excavated from the work areas. The power plant, metal building, and rear section of the main building will be demolished to make room for the remedial activities. Cleared vegetation, debris, and building materials will be disposed of in the appropriate off-site facilities.

- Excavation, Treatment, and Disposal - Approximately 54,000 yds^3 of contaminated soils and sediments will be excavated wherever heavy metals, cyanide, PCBs, PAHs, and pesticides are present above the cleanup levels. Once removed, the contaminated soils and sediments will be separated from any solid wastes and debris. Materials will be tested to determine if they contain contamination at levels above the cleanup goals. The contaminated materials will be tested and further separated into materials that will be treated and not treated. The solid waste, debris, and treated and un-treated soils and sediments will be disposed in the appropriate off-site disposal facilities.

  The on-site treatment will be for materials requiring treatment for off-site disposal (estimated to be 6,000 yds^3 treated). The most appropriate treatment method(s) will be determined from the treatability studies. The treatment will eliminate the potential for contaminants to leach from these materials. The treatment selected will reduce the contamination leaching from the soils and sediments. The treatment technology(ies) will most probably be some form of solidification/stabilization. The treatment of the contaminated materials will be done in a temporary enclosure to the extent practicable to ensure that workers and residents in the area are not impacted by airborne dust and contaminants. Appropriate engineering controls will be used to reduce all other dust emissions from excavation and storage of materials, and truck traffic on-site.

  Soils and sediments with contaminant concentrations that do not exceed the cleanup goals will be placed back into the areas that have been excavated. Additional fill will be brought onto the Site to properly contour the Site. Once the contamination is removed from the various Site areas, each area will be regraded and revegetated to its original pre-contamination condition to the extent possible. Salt marsh areas that are excavated to remove contamination will be regraded and revegetated to approximate the original conditions of the area remediated. Erosion protection will be provided in each area, as appropriate, to prevent bank scouring and erosion.

- Monitored Natural Attenuation with Phytoremediation of the Site Groundwater - The risks from the groundwater contaminants will be significantly reduced by removing contamination sources. The groundwater contamination will be further reduced by natural attenuation. Additional measures to control the groundwater elevation will be by phytoremediation (trees will be planted to lower the groundwater). This should limit the flow of groundwater through areas where residual contamination still remains at the Site. The groundwater should meet the cleanup goals approximately ten years after the removal of the contamination sources.

- Monitoring and Institutional Controls - A long-term monitoring program will be undertaken to assess the effectiveness of the remedy over the long term. Soils, sediments, groundwater, surface water, and vegetation will be sampled and analyzed. Institutional controls will be established on the Site properties to ensure that the remedy is protective of human health and the environment. Typically, institutional controls will be restrictive covenants running with the land in perpetuity, and may include easements. Institutional controls will be established to prevent any future use of the groundwater at the Site for drinking water. Also, institutional controls will be established to limit other activities at the Site. Such limits include restricting the types of use and construction within portions of the Commercial Area to only commercial and industrial uses (i.e., no residential use). Institutional controls may also be established in the Non-Commercial Area to limit the use of that area to certain recreational uses consistent with the risk assessment and response actions conducted in that area.

- Review of the Completed Remedy - Because residual contamination will remain at the Site above levels that allow for unlimited use and unrestricted exposure, the Superfund statute requires that EPA review the remedial action no less often than each five years after the cleanup process begins. The purpose of this review is to ensure that human health and the environment are protected These periodic reviews will continue until no hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure.

The overall Site cleanup strategy is to address the principal and low level threats at the Site. The Selected Remedy addresses these threats by removing the sources of contamination, monitoring the groundwater, and establishing limits to certain activities through institutional controls.

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

See attached ROD data certification checklist.

AUTHORIZING SIGNATURE

3/10/00
Date

Patricia L. Meaney
Patricia L. Meaney, Director
Office of Site Remediation and Restoration
EPA - New England

ATLAS TACK CORPORATION
SUPERFUND SITE ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file of this site.

• Chemicals of concern and their respective concentrations.

• Baseline risk represented by the chemicals of concern.

• Cleanup levels established for chemicals of concern and the basis for these levels.

• How source materials constituting principal threats are addressed.

• Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD.

• Potential land and ground-water use that will be available at the site as a result of the Selected Remedy.

• Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.

• Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

ATLAS TACK CORP. SUPERFUND SITE

DECISION SUMMARY

FOR

RECORD OF DECISION

March 2000

U.S. Environmental Protection Agency - Region I

New England

Table of Contents

Figures

Tables

Appendices

ATLAS TACK CORP. SUPERFUND SITE
RECORD OF DECISION
MARCH 2000

I. Site Name, Location and Description

The Atlas Tack Corp. Superfund Site (the Site) is located at 83 Pleasant St., Fairhaven, Bristol County, Massachusetts, as shown on Figure 1. This Site's CERCLIS identification number is MAD001026319. The United States Environmental Protection Agency (EPA) is the lead entity at this Site. The Site is a former industrial manufacturing facility whose soils, sediments, groundwater, and surface water are contaminated with heavy metals, volatile organic compounds and other contaminants. The Site's wetlands are filled with wastes from the former manufacturing processes.

The Site includes the entire Atlas Tack Corp. property (owned by the Atlas Tack Corp.), a disposal area at the end of Church Street on the Hathaway Braley Wharf Company property, and a portion of Boys Creek and its tidal marsh. The Site is located in primarily a residential area with a tidal marsh bordering the back of the property to the east as shown on Figure 2. The Fairhaven hurricane barrier, constructed in the mid-1960s, cuts through the tidal marsh. There is a bike path and a boat-related industry just north of the Site and an elementary school about 200 feet northwest of the Site. The Atlas Tack property comprises approximately 13.6 acres of commercial area and 7.2 acres of wetland area. The disposal area on the Hathaway Braley Wharf Company property is approximately 3.2 acres in size and abuts the Atlas Tack property on the southeast. The total Site area covers about 24 acres.

II. Site History and Enforcement Activity

The Atlas Tack Corp. facility was built in 1901 by Fairhaven resident Henry Huttleston Rogers to provide employment in Fairhaven. In 1967, the current owner, Great Northern Industries of Boston, purchased the company and operated it until 1985 when the plant shut down.

Between 1901 and 1985 the Atlas Tack Corp. manufactured wire tacks, steel nails, rivets, bolts, and similar items. The facility's operation included electroplating, acid-washing, enameling, and painting. From at least the early 1940's to the 1970's, process wastes containing acids, metals such as copper and nickel, and solvents were discharged into drains in the floor of the main building. As a result, some of these chemicals have permeated the floors and timbers of the building and migrated to adjacent soils and groundwater.

The plating area, located in the eastern part of the building, included a cyanide treatment pit.

Sludge and liquid from this operation contained cyanide, and the surrounding building materials may have residual cyanide contamination. The wastewater from these operations was discharged to an on-site lagoon from approximately 1940 through 1973, and wastewater from the electroplating and pickling operations was also discharged to the lagoon until 1974. From 1978 to 1985, the remaining industrial discharge from manufacturing operations was piped to an outfall from the Fairhaven municipal sewer system where it was assimilated into the outfall discharge.

The 1984 discharge permit application from Atlas Tack showed that 400 gallons from the wash process and 100 gallons from the rinse process were generated daily and apparently discharged to the Fairhaven sewer. Wastes from the cleaning process were reportedly disposed of off-site. Sludge from the neutralization process was reportedly stored on-site in 55-gallon drums until proper off-site disposal was arranged.

Since the closing of the facility in 1985, some RCRA hazardous wastes in drums were removed by truck from the Site and by excavation of the lagoon as the result of a Massachusetts Department of Environmental Protection (DEP) action. Containerized chemicals remaining in and around the buildings were removed in November 1986.

In addition, EPA has identified a dump area on the Hathaway Braley Wharf Company property that may have received wastes from the Atlas Tack Corp. through 1974. Known as the Church Street disposal area, it is located approximately 500 feet southeast of the main Atlas Tack Corp. building.

In 1984, analysis of environmental media samples (e.g., soil, sediment, surface water) detected contaminants in the marsh and surface water south of the lagoon. Groundwater monitoring conducted in 1987 revealed elevated levels of benzene, toluene, chromium, and cyanide at the Site.

In June 1988, the Atlas Tack Corp. Site was proposed for inclusion on EPA's National Priorities List (NPL), a list of the top priority hazardous waste sites. In February 1990, the Site was placed on the NPL, making it eligible for federal funding for investigation and cleanup. Prior to being placed on the NPL, the Site was (and still is) listed on the DEP hazardous waste sites list in January 1987. In 1985, the DEP took legal action against Atlas Tack Corp. for violations under Massachusetts law, which resulted in the removal of sludge and contaminated soil from the lagoon, and drums of waste material from the main building. In 1991, the DEP settled with the Atlas Tack Corp. for over $877,000 to cover past costs, penalties, and interest for this cleanup action.

EPA issued an Order in 1992 to place and maintain a fence around the Site. The Atlas Tack Corp. placed a fence around the Site, but has had problems maintaining the fence.

On April 27, 1998, EPA issued a General Notice of responsibility and potential liability to the Atlas Tack Corp. On July 31, 1998, EPA issued a General Notice of responsibility and potential liability to the Hathaway Braley Wharf Company. Special Notices will be issued after the signing of the ROD.

On August 13, 1998, the Bristol County Superior Court in the Commonwealth of Massachusetts entered a judgment against the Atlas Tack Corp. in an action against it by the Fire Chief for the Town of Fairhaven. This lawsuit was initiated by the Fairhaven Fire Department in order to compel the Atlas Tack Corp. to abate the fire hazards at the Site. By assenting to entry of this judgment, the Atlas Tack Corp. agreed to perform work, including the following: 1) restore, if necessary, and maintain in good working order the sprinkler and fire alarm systems throughout the front section of the main building (offices, two stories) and the rear section of the main building (factory, three stories); 2) maintain the front section of the main building in a structurally sound condition; 3) close openings in the front and rear sections of the main building and secure them from entry; 4) maintain 24-hour/day security in the front and rear sections of the main building; and 5) remove the roof and all wood materials from the middle section of the main building (with the brick walls permitted to be left standing if determined to be safe). During the fall of 1998 until January 1999, the Atlas Tack Corp. demolished the middle section of the main building. As a result, most of the main building has now been demolished, and the soils in this area, formerly covered by the building structure, are now exposed to the elements.

On August 9, 1999, EPA issued an Order to the Atlas Tack Corp. to remove asbestos-containing materials from the rear (now free-standing) three-story building and power plant at the Site. Because the Atlas Tack Corp. failed to comply with this administrative order, EPA began the asbestos removal process on September 28, 1999. On February 9, 2000, EPA completed the removal of asbestos-containing materials.

III. Community Participation

Throughout the Site's history, community concern and involvement has been very high. EPA has kept the community and other interested parties apprised of the Site activities through informational meetings, fact sheets, press releases and public meetings.

In June 1991, EPA conducted community interviews to gather information for the preparation of the Community Relations Plan. During November 1991, EPA released a community relations plan which outlined a program to address community concerns and keep citizens informed about and involved in activities during remedial activities. The Community Relations Plan was updated several times with the last update in April 1997.

In May 1991, EPA issued a fact sheet describing the Site history, the Superfund process, EPA's plans for the Remedial Investigation/Feasibility Study (RI/FS) site investigations, and opportunities for public involvement. On May 30, 1991, EPA held an informational meeting in the Fairhaven Town Hall to describe the plans for the RI/FS. In July 1991, EPA announced start of field studies at the Site. On July 11, 1995, EPA held a public information meeting in the Hastings Junior High School in Fairhaven to discuss the results of the RI report (Weston, 1995). In July 1995, EPA issued a Fact Sheet on the RI. On August 6, 1998, EPA held an informational meeting in the Fairhaven Town Hall to discuss the results of the FS Report (Weston, 1998b). During the August

1998 meeting, a summary of the FS was presented and a FS fact sheet handed out.

On December 1, 1998, EPA made the administrative record, including the Proposed Plan (EPA, 1998), available for public review at EPA's Record Center in Boston and at the Millicent Public Library in Fairhaven. Also on December 1, 1998, EPA held an informational meeting in the Fairhaven Town Hall to discuss the results of the RI and the cleanup alternatives presented in the FS, to present the Agency's Proposed Plan, and to answer questions from the public. From December 2, 1998 to February 19, 1999, the Agency held an 80 day public comment period to accept public comment on the alternatives presented in the FS and the Proposed Plan and other relevant documents previously released to the public. The comment period was extended twice at the request of the Fairhaven Board of Selectmen and the Atlas Tack Corp. On January 27, 1999, EPA held an additional informational meeting in the Fairhaven Town Hall to discuss questions raised at the December 1, 1998 meeting about the Proposed Plan. On February 11, 1999, the Agency held a public hearing to discuss the Proposed Plan and to accept any oral comments. The Agency's response to the oral and written comments are included in the Responsiveness Summary (see Appendix A). The transcripts of the January 27 and February 19, 1999 meeting/hearings, comment letters, and other relevant documents are in the updated Administrative Record. The Administrative Record Index is in Appendix B.

The public informational meetings and the Public Hearing were televised on local cable-access TV to reach as broad an audience as possible. An article about the December 1, 1998 Public Informational Meeting was published in the "New Bedford Standard Times" on November 30, 1998. A brief analysis of the Proposed Plan was in The Advocate weekly newspaper on December 10, 1998. An article about the January 27, 1999 Public Informational Meeting and Public Hearing was in the "New Bedford Standard Times" on January 24, 1999. Notices of all meetings were sent to the mailing list. Public Notices were placed in the "Fairhaven Advocate" on December 22, 1998 and January 28, 1999 regarding the two extensions of the public comment period.

Additional community relations activities conducted by EPA include the following. On May 18, 1992, EPA and DEP held a public information meeting to discuss the progress of Site activities and to update the schedule for future activities. On April 6, 1995, EPA and DEP held a public informational meeting to give an update of Site activities and discuss the formation of a Citizen/Government Work Group. On August 15, 1995, EPA established a Citizen/Government Work Group. The Citizen/Government Work Group also met on November 15, 1995; April 10, 1996; September 10, 1996; February 25, 1997; November 12, 1997 (to discuss the Technical Memorandum); and May 13, 1998 (to discuss the draft FS Report). All Citizen/Government Work Group meetings were held in the Fairhaven Town Hall.

As an additional effort to inform the public, the Town of Fairhaven hired Sea Change, Inc. to assemble an independent panel to review the RI, FS, and Proposed Plan. Sea Change's purpose has been to provide citizens and government officials with independent scientific and technical information. Sea Change held public panel sessions: on March 19, 1998 to discuss the RI; on June 25, 1998 to discuss the draft FS; and on October 1, 1998 to discuss the FS. The Sea Change panel presented comments on the RI, FS, and Proposed Plan. As with all public comments, responses to the Sea Change panel's comments are presented in the Responsiveness Summary in Appendix A.

EPA and the DEP held a meeting with Town representatives on April 10, 1996 and a public meeting on April 24, 1996 to discuss the future land use of the commercial section of the Atlas Tack property. In the meetings, the residential and commercial/industrial types of cleanup were discussed. On May 22, 1996, the Town held a public meeting with abutting property owners to vote on the type of cleanup they preferred. The majority of the attendees voted in favor of the commercial cleanup and the Board of Selectmen concurred with this vote. Details of these meetings are in Appendix A.1 of the FS (Weston, 1998b). As a result of these meetings, EPA decided to split the Site into two different areas, "Commercial" and "Non-commercial." The future use and human health risk assessment were modified from the RI (Weston, 1995) and will be discussed in Sections VI. and VII. of this document.

There is no Technical Assistance Grant (TAG) for this Site. TAG information and the process of applying for a grant was discussed at several meetings, but no community group was interested in applying.

IV. Scope and Role of Response Action

The selected remedy was developed by combining components of different source control and management of migration alternatives, which were considered in the FS, to obtain a comprehensive approach for Site remediation. The selected remedy for the source areas includes the excavation of wastes, soils, and sediments with contaminant concentrations greater than the cleanup goals, and the off-site disposal of these materials at an appropriate licensed waste disposal facility. On-site treatment of some of the contaminated materials, where practicable, will be conducted to reduce the off-site disposal costs. The concentration of contaminants in the groundwater will be reduced to less than the cleanup goals by removing the source in the soils and allowing natural attenuation enhanced by phytoremediation to remediate the Site groundwater over time.

This remedial action will address the following principal threats (**bolded** below), per the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), to human health and the environment posed by Site conditions:

- Worker exposure to **contaminated surface soil and sludge in the Commercial Area,**

- Migration of **contamination from the commercial building, the Solid Waste and Debris (SWD) Area, and the Marsh surface soil** to groundwater, surface water, and creek sediment,

- Exposure of biota to **contaminated surface soil and sediment in the SWD and Marsh Areas**, and to **contaminated surface water and sediment in Boys Creek**, and

- Human ingestion of **contaminated shellfish** from Boys Creek.

This Site has not been, nor expected to be, divided into operable units.

V. Summary of Site Characteristics

Chapter 1 of the FS (Weston 1998b) contains an overview of the RI (Weston, 1995). The Site was divided into the Commercial Area, various Non-Commercial Areas (Solid Waste and Debris, Marsh, and Creek Bed Areas), and Groundwater, as shown in Figure 2. The contaminants were disposed and spilled onto the Commercial, and Solid Waste and Debris Areas. These areas still contain the majority of the contamination currently remaining at the Site. The contaminants were discharged from wastewater or migrated into the Marsh and Creek Bed Areas. The chemicals of concern (COCs), and the maximum and exposure point concentrations for the COCs detected in the soils, groundwater, sediments, and shellfish at the Site are presented in Tables 1 to 5. The chemicals posing a potential risk to ecological receptors detected in soils, vegetation, biota, sediments, and surface water are presented in Table 6. The waste types and amounts for each area are shown in the Table C-1 in Appendix C. The significant findings of the RI are summarized below.

A. Soil

1. Commercial Area: This area includes both the soils surrounding the building, and sludges and waste areas inside and formerly inside the building (the middle section of the main building was demolished in late 1998; see Section II. above). Contaminants identified in these areas were metals (including arsenic, beryllium, cadmium, chromium, copper, lead, nickel, and zinc), cyanide, volatile organic compounds (VOCs, primarily toluene), semi-volatile organic compounds (SVOCs, primarily polycyclic aromatic hydrocarbons [PAHs]), and polychlorinated biphenyls (PCBs) (Arochlor 1260). The main waste area is the Plating Pit which contains about 600 cubic yards of material. The rest of the Commercial Area contains about 10 cubic yards of waste. The Plating Pit, Tack Wash Area, Pickling Trench, and Manhole 2 were formerly in the middle section of the main building and are now outside. The Tumbling Room, Exotic Plating Treatment Sump, and Catch Basin/Floor Drain (formerly Manhole 1) Areas are in the rear section of the main building and currently remain inside.

Rainfall causes the leaching of the Site contaminants into the groundwater resulting in their eventual migration to the marsh and Boys Creek. Surface water runoff during storm events also is a means of migration of contaminants from the Commercial Area to other areas on and off the Site. Additionally, some of the contaminants leach from the soils located below the groundwater table.

2. Solid Waste and Debris Area: This area includes the Fill Area, Former Lagoon Area, and Commercial and Industrial Debris (CID) Area at the eastern end of Church Street. Contaminants identified in these areas were metals (including antimony, copper, lead, and zinc), cyanide, VOCs, PAHs, PCBs, and pesticides.

The contamination in this area is migrating via groundwater and surface water runoff to Boys Creek and Marsh Areas, and eventually off the Site into Buzzards Bay. Groundwater moves relatively freely though the contaminated fill and becomes contaminated. Contaminated soils near the surface can erode from rain and subsequently flow into Boys Creek. Contamination in the groundwater will either be sorbed onto sediments in Boys Creek, or be transported into the surface water and flow off the Site. The vegetative cover in the Fill Area is sparse, so contaminants from that area can migrate via wind-blown dust to other areas on and off the Site.

3. Marsh Area: Contaminants identified in this area were metals (including cadmium, copper, and zinc), cyanide, and VOCs.

There is limited migration of contaminants once in the Marsh Area. The contaminant concentrations in the marsh near the source area (Solid Waste and Debris Area) are as much as an order of magnitude higher than the contaminant concentrations outside the hurricane barrier. The contamination in this marsh (and marshes in general) have been adsorbed by the marsh soils and/or vegetation. Also, the hurricane barrier limits surface water flow into this marsh and the flushing out of this marsh. This limits movement of contamination in this area.

B. Groundwater

Contaminants identified in the groundwater were metals (including beryllium, cadmium, copper, lead, nickel, and zinc), cyanide, and VOCs. Groundwater below the Site exceeds Ambient Water Quality Criteria (AWQC) for cadmium, copper, lead, mercury, nickel, zinc, and cyanide. Contaminated groundwater flows from under the Site in a northeasterly direction and discharges into the marsh and Boys Creek.

C. Surface Water

The surface water bodies at the Site include the main channel and tributaries of Boys Creek. AWQC are exceeded in these water bodies for the following metals: arsenic, cadmium, copper, lead, nickel, silver, and zinc; and cyanide. Contaminated groundwater and rainfall runoff from the upland portion of the Site is a significant source of this contamination. The water in Boys Creek flows into Buzzards Bay. Buzzards Bay is about 2000 feet from the current sources of Site contamination. The result is a net movement or flux of contamination into Boys Creek and seaward into Buzzards Bay.

D. Sediment

The contaminated sediments at the Site are located in the main channel and tributaries of Boys Creek. These are collectively referred to as the Creek Bed Area. Contaminants identified in this area were metals (arsenic, cadmium, copper, nickel, and zinc); cyanide; and pesticides.

Contaminants that reach the Creek Bed Area via groundwater or rain runoff can either be absorbed by the sediments or migrate into the surface water, and eventually discharge into Buzzards

Bay.

E. Biota

1. Marsh Area: The vast majority of the Marsh Area is high marsh, with well-established vegetation. See Figure 3-12 of the RI (Weston, 1995) for locations of marsh vegetation. The predominant vegetation in some areas at higher elevations (most notably areas close to the CID Area and the hurricane dike) is *Phragmites communis* (common reed). The predominant vegetation in most of the high marsh is *Spartina patens* (salt hay). Fauna that inhabit the Marsh Area include the great blue heron, the black duck, the meadow vole, and a variety of other small mammals and surface-feeding ducks.

2. Creek Bed Area: Boys Creek, some of its tributaries, and the hurricane dike, lie within the Marsh Area. Boys Creek and its tributaries are areas of low marsh. The main channel of Boys Creek is typically devoid of vegetation; however, *Spartina alterniflora* (spike grass) is established along the banks and in the small tributaries. Fauna that inhabit the Boys Creek sediments include ribbed mussels, soft shell clams, and benthic and epibenthic organisms. The great blue heron, the black duck, and a variety of other ducks also frequent Boys Creek.

Concentrations of heavy metals in surface waters at the Site area are high, particularly north of the hurricane barrier. Concentrations of copper, lead, mercury, nickel, and zinc exceed AWQC guidelines. The Site shellfish and fish were found to contain metals, SVOCs, and pesticides in concentrations greater than those found in the shellfish and fish at the background location on West Island in Fairhaven.

Samples of sediment in the marsh and Boys Creek show elevated concentrations of cadmium, copper, lead, nickel, zinc, and pesticides (DDT and DDE) as compared to background concentrations. Because of these Site contaminants, the sediments are degraded in the stream and associated salt marsh habitats in much of the area north of the hurricane barrier and about 700 feet south of the barrier to bioassay station 158 (in Figure 2-2 in Weston, 1997b).

A complete discussion of site characteristics can be found in Sections 3 and 4 of the RI Report (Weston, 1995).

VI. Current and Potential Future Site and Resource Uses

A. Land Uses

The Atlas Tack Corp. property is currently zoned industrial, although there are currently no industrial or commercial activities at the Site. There are, however, abandoned industrial and commercial buildings at the Site that previously housed the Atlas Tack operations. As previously discussed in Section II, the middle section of the main building has recently been demolished by the

Atlas Tack Corp., as ordered by the Bristol County Superior Court as part of the final judgment in a civil action. With respect to the future use of the Site, it cannot be assumed that the buildings in existence today will remain in place. In addition, as previously discussed in Section III, EPA and the DEP held meetings with Town representatives and citizens to discuss the future use of the commercial section of the Atlas Tack property. The western portion of the property was identified as potentially viable commercial property. The Town held a separate meeting and voted that the reasonably anticipated land use for this portion of the property was Industrial/Commercial. Details of these meetings are in Appendix A.1 of the FS (Weston, 1998b). The cleanup goals for the commercial part of the property are based on the potential exposure of a commercial worker to contaminants. Institutional controls will be required for at least parts of this Site to prevent the commercial portion of the Atlas Tack property from being used in a way that is not protective of human health. Possible institutional controls (e.g., deed restrictions, including easements) on the property could limit the use to commercial or other less intrusive activities, which are consistent with the cleanup levels established by the selected remedy. The selected remedy does not prevent some other future use (such as park land), if the risk scenario results in an acceptable risk range.

The eastern portion of the Atlas Tack Corp. property, which has been partially filled, is a salt marsh and wetlands. After the removal of the contamination and restoration of the fill area, the salt marsh and wetlands are expected to retain their current characteristics. The fill area will be returned to a functioning salt marsh environment at the conclusion of the selected remedy.

The Hathaway Braley Wharf Company property is mostly a wooded area with some fresh water wetlands. After the removal of the contamination and restoration, this area will most likely remain the same as it is now.

B. Groundwater Uses

The groundwater beneath and in the vicinity of the Site is not currently used as a drinking water supply nor is it anticipated that it would be in the future. Even if this groundwater were not contaminated, some of it would nonetheless be unsuitable for potable purposes because of the influence of salt water. All homes in the vicinity of the Site are on public water. The closest public water supply well is about one mile from the Site. When in operation, the Atlas Tack Corp. reportedly used the Fairhaven public water for drinking and an on-site well for industrial uses.

The DEP has not classified the groundwater as a current or potential drinking water supply. In April 1996, EPA published its "Groundwater Use and Value Determination Guidance" (EPA, 1996a). This document established EPA-New England's approach to determine a site specific "use" and "value" of the groundwater at a Superfund Site. This determination is utilized by EPA in establishing remedial action objectives and making groundwater remedial action decisions. In March of 1998, EPA entered into a Memorandum of Agreement with the DEP, whereby the DEP would develop the groundwater use and value determinations. In March of 1998, the DEP submitted a "low" Groundwater Use and Value Determination for the Atlas Tack Corp. Site. Details of this are in Appendix A.2 of the FS (Weston, 1998b).

Because the groundwater under the Site is contaminated above certain human health criteria, and therefore not suitable for human consumption (see Table 3 for a summary of contamination found at certain well locations), the Site will require institutional controls (e.g., deed restrictions, including easements) to prevent the use of the groundwater for drinking water. The properties surrounding the Site are not currently impacted by the groundwater contamination from the Site. There is no evidence to suggest that groundwater in the area surrounding the Site will be used for drinking water, since the Town provides public water, and a drilling permit from the Town's Health Department would be required to legally drill a well. The removal of most of the contamination source is expected to significantly reduce the levels of contamination in the groundwater over time and the restriction on groundwater use could be eliminated once the groundwater meets all human health criteria.

C. Surface Water and Marsh Area Uses

The Site is located within the Boys Creek watershed, with Boys Creek discharging into Buzzards Bay via Priest Cove, northwest of Pope Beach. Surface drainage from the Site discharges directly into Boys Creek along the northern portion of the Site and indirectly via overland flow into small tributaries and mosquito ditches located within the Boys Creek marsh. The upper watershed of Boys Creek is primarily urban/residential with surface drainage primarily via storm sewer systems. The lower portion of the watershed is a tidal salt marsh located north and south of the hurricane barrier extending southward to Priest Cove. Boys Creek discharges into Buzzards Bay, northwest of Pope Beach and is tidally influenced. Tidal and non-tidal wetlands are located to the northeast and southeast of the Site along the floodplain of Boys Creek.

Boys Creek is not currently used as a drinking water supply nor is it anticipated that it would be in the future because it is tidally influenced. All homes in the vicinity of the Site are on public water which originate from groundwater wells. The closest town well is about a mile from the Site. When in operation, the Atlas Tack Corp. reportedly used the Fairhaven public water for drinking and an on-site well for industrial uses. In addition to Boys Creek as a surface water body, the Site has a small reservoir that was used by the Atlas Tack Corp. as a backup source of water for fire protection. It is unlikely that this reservoir will be used for fire protection purposes since most of the main building has been demolished. It should be noted that no contaminants in excess of any human health based or ecologically based levels were found in this reservoir

Boys Creek and its associated marsh areas are habitats for plants, fish and wildlife, and it is anticipated that these areas will remain the same after the remedial action. For a detailed description of the ecological environment, refer to Section 3.5.4 of the RI (Weston, 1995).

VII. Summary of Site Risks

Baseline human health and ecological risk assessments were performed, as part of the RI and updated as part of the FS, to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. They provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. The human health and ecological risk assessments followed a four step process: 1) contaminant identification, which identified those hazardous substances which, given the specifics of the Site, were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity/effects assessment, which considered the types and magnitude of adverse effects associated with exposure to hazardous substances, and 4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks. A summary of only those aspects of the human health and ecological risk assessments which support the need for remedial action are discussed below. Risks not significant enough to warrant a response, such as risks to trespassers contacting chemicals of concern in the sediments and soils (Tables 2 and 4), will not be discussed because EPA will not be responding to these risks. Likewise, the human risks associated with the groundwater (Table 3) will not be discussed because they do not directly serve as a basis for this remedial action.

Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to Chapter 2 of the "Update to the Human Health Risk Assessment and Development of Risk-Based Clean-Up Levels" (Weston, 1998a) for a more comprehensive risk summary of all exposure pathways and for estimates of the central tendency risk.

A. Human Health Risk Assessment

1. Identification of Chemicals of Concern

The 62 chemicals of concern (COCs) listed in Tables 1 and 5 of more than one hundred chemicals detected at the Site were selected for evaluation in the human health risk assessment. The COCs in Tables 1 and 5 were selected to represent potential site related hazards based on their toxicity, concentration, frequency of detection, and mobility and persistence in the environment. They represent a subset of all the compounds evaluated in the baseline risk assessment. Tables 1 and 5 also contain the exposure point concentrations (EPCs) used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment (i.e., the concentrations that were used to estimate the exposure and risk from each COC). Estimates of average or central tendency exposure concentrations can be found in Tables 2-2, 2-4, 2-5, 2-6, and 2-8 of the Update to the Human Health Risk Assessment (Weston, 1998a).

Table 1 presents the COCs and EPCs for these COCs detected in the top two feet of the commercial soils (i.e., the concentrations that were used to estimate the exposure and risk to the future commercial/industrial [maintenance] worker from each COC in the soil). Table 1 includes the range of concentrations for each COC, the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the EPC, and the statistical measure of how the EPC was derived. The 95% Upper Confidence Limit (UCL) of the arithmetic mean was used as the EPC for all chemicals with the exception of beta-BHC and 4,4'-DDT (maximum detected concentration was used for the EPC in accordance with EPA guidance due to the data variability).

Table 5 presents the COCs and EPCs for each of the COCs detected in hard shell clams from Boys Creek (i.e., the concentrations that were used to estimate the exposure and risk to the future adult trespasser from each COC in the hard shell clams). Table 5 includes the range of concentrations for each COC, the frequency of detection, the EPC, and the statistical measure of how the EPC was derived. Because of the small sample number (i.e., 4) and low detection frequency, the EPCs for organics defaulted to the maximum detected concentration (with the exceptions of bis(2-ethylhexyl)phthalate, and di-n-butylphthalate). For the metals, there was a higher detection frequency and as a result, the 95% UCL served as the EPC except for aluminum, arsenic, and zinc.

2. Exposure Assessment

Potential human health effects associated with exposure to the COCs were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. Although the industry which formerly occupied the Site has ceased operations, future commercial use of the Site was assumed to be the most probable future Site use. The Atlas Tack Corp. property is presently zoned for commercial/industrial use. While residential properties abut the facility and residential land use even served as a basis for the initial risk evaluation in the RI (Weston, 1995), the series of public meetings held in Fairhaven in 1996 resulted in the conclusion that residential land use of the Site was not a plausible future Site use. At these meetings, commercial use was identified as the preferred use for the portion of the Site referred to as the commercial area. Less intense uses for the remainder of the Site for recreation and open space were considered reasonable future uses in what has been designated "non-commercial areas." People were assumed to have ready access to the non-commercial areas of the Site, and as such, a trespasser scenario based upon the consumption of shellfish from Boys Creek was evaluated in the risk assessment. The following is a brief summary of the exposure pathways that were found to present a significant risk. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Chapter 2 of the Update to the Human Health Risk Assessment (Weston, 1998a).

Of the potential exposure scenarios evaluated, risks to maintenance workers from exposure to the commercial area soils and risks to consumers of shellfish from Boys Creek were found to be significant (exceed either a 1×10^{-4} excess cancer risk or a HI>1). Adult maintenance workers were assumed to incidentally ingest and absorb contaminants present in surface soils (0-2 feet) through the skin 250 days/yr for 25 years. The maintenance worker was assumed to ingest 136 mg/day of soil and have 2,500 cm^2 of skin surface area exposed per exposure event with a soil loading of 0.08 mg/cm^2. The worker's exposure was based on one rate of exposure to soils from both inside and outside the building. The removal of most of the main building, in late 1998, did not change any exposure scenario, and thus did not change the risk calculations. Potential risk from the consumption of shellfish (hardshell clams) from Boys Creek was evaluated assuming that an adult would eat about 3.75 lbs. of Boys Creek hardshell clams per year for 30 years. Actual hard shell clam tissue analysis served to generate EPCs for this medium.

3. Toxicity Assessment

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level with the chemical specific cancer slope factor (CSFs). CSFs have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" - or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the CSFs relevant to the risk evaluation can be found in Table 7.

Table 7 provides carcinogenic risk information that is relevant to the COCs in the commercial area soils and hard shell clams from Boys Creek. Table 7 provides the CSFs, the weight of evidence, and the source ("Integrated Risk Information System" [IRIS] or "Health Effects Assessment Summary" [HEAST]). Since just the oral and dermal routes of exposure were evaluated in this risk assessment, only oral and dermal CSFs are presented. At this time, there are no verified or provisional CSFs available for the dermal route of exposure. Thus, the dermal CSFs used in the assessment have been extrapolated from oral values. An adjustment factor (gastrointestinal [GI] absorption factor) was derived by determining the degree to which each chemical was absorbed in the GI tract. The oral CSF was then divided by the GI absorption factor to obtain the dermal ("adjusted") CSF.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g. liver) within or across all media to which a given individual may reasonably be exposed. A HI <1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the reference doses relevant to this hazard evaluation can be found in Table 8.

Table 8 provides non-carcinogenic risk information which is relevant to the COCs in the commercial area soils and hard shell clams from Boys Creek. Table 8 provides the type of exposure (chronic or subchronic), the reference doses (RfDs), the primary target organs on which the RfDs are based, and the source (IRIS or HEAST). Since just the oral and dermal routes of exposure were evaluated in this risk assessment, only oral and dermal RfDs are presented. At this time, there are no verified or provisional RfDs available for the dermal route of exposure. Thus, the dermal RfDs used in the assessment have been extrapolated from oral values. An adjustment factor (GI absorption factor) was derived by determining the degree to which each chemical was absorbed in the GI tract. The oral RfD was then multiplied by the GI absorption factor to obtain the dermal ("adjusted") RfD.

4. Risk Characterization

a. Soil and Sediment Exposure Pathways

Table 9 depicts the carcinogenic risk summary for the COCs in Commercial Area surface soils evaluated to reflect present and potential future incidental ingestion and dermal contact with surface soils in the Commercial Area by a maintenance worker corresponding to the RME scenario. These risks were based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's exposure to the commercial soils, as well as the carcinogenic potency of the COCs. The total risk from direct exposure to contaminated commercial soils at the Site to a future maintenance worker is 1.5×10^{-3}. The COCs contributing most to this risk level are several PAHs (i.e., benzo[a]pyrene, benzo[a]anthracene, dibenzo[a,h]anthracene and indeno[1,2,3-cd] pyrene), as well as PCB (Arochlor 1260). Risk for each chemical was approximately equally distributed between oral and dermal exposure.

Excess cancer risks attributed to the maintenance workers' potential contact with surface soils both inside and outside the former building (1.5×10^{-3}) is estimated to exceed the benchmark for remedial action (1×10^{-4}). Benzo(a)pyrene has been identified as the compound contributing most significantly to this risk estimate. Except for lead, the potential for non-carcinogenic hazards for the maintenance worker exposed to commercial area soils was estimated to be below the benchmark of 1.0 for the specific endpoints evaluated suggesting that the potential for non-carcinogenic effects is unlikely.

While significant lead contamination was detected in commercial area surface soils (predominantly inside the former building), a baseline risk evaluation was not performed for the exposure of maintenance workers and their offsprings to lead in soils. Instead, EPA's approach for assessing risks associated with non-residential adult exposures to lead in soil was used to assess allowable lead concentrations at the Site (EPA, 1996b). The adult lead model methodology focuses on estimating fetal blood level concentration in women exposed to lead contaminated soils. This evaluation resulted in the conclusion that lead concentrations in surface soil in excess of 600 ppm would not provide sufficient protection (using a blood lead threshold of 10 ug/dl and protection of 95% of the potentially exposed fetuses). This in turn led to the identification of surface soils inside the building as the only portion of the Commercial Area where the 95% UCL of the mean lead concentration exceeded 600 ppm, and therefore warranted remediation (refer to Section XI. Selected Remedy).

The human health risk assessment associated with a maintenance worker's contact with Commercial Areas soils is subject to uncertainties concerning the amount of soil that may be ingested and the amount of contamination in soil that may be absorbed via the skin. In the absence of site specific studies, EPA has relied on information obtained from the literature to support its choice of soil ingestion rates and dermal absorption of contamination from soils.

In summary, the total risk level indicates that, if no clean-up action is taken, an individual would have an increased probability of approximately 2 in 1,000 of developing cancer as a result of site-related exposure to the COCs at the frequency, duration, and magnitude assumed in the risk evaluation.

b. Shellfish Exposure Pathway

Table 10 depicts the carcinogenic risk summary for the COCs in hard shell clams evaluated to reflect present and potential future ingestion of hard shelled clams obtained from Boys Creek corresponding to the RME scenario.

Table 10 provides cancer risk estimates for an adult consumer of shellfish (hard shell clams) obtained from the Site. These estimates were developed by taking into account various conservative assumptions about the frequency and duration of an adult's dietary habits with regard to shellfish consumption, as well as the carcinogenic potency of the COCs. The total cancer risk from shellfish ingestion was estimated to be 1.45×10^{-4} which is close to EPA's benchmark generally used to determine the need for remedial action (1×10^{-4}). Arsenic contributed 84% of total shellfish ingestion risk. Various organic compounds contributed the remaining 16%. The highest contributor of the organics was 3,3'-dichlorobenzidene at 1.08×10^{-5} (7% of total risk).

The human health risk estimates associated with the consumption of shellfish are subject to some uncertainty. This uncertainty can be traced to a reliance on a limited data set for the extent of hard-shelled clam contamination, as only four samples were analyzed for chemical contamination. Also, there is uncertainty in the amount of shellfish consumed from the study area. The shellfish beds have been closed for some period of time due to bacterial contamination. If this bacterial contamination no longer required the area to be closed to shellfishing, there still would be a need to address the risk due to the Site related contamination.

In summary, the total risk level indicates that, if no clean-up action is taken, an individual would likely have an increased probability of approximately 1 in 7,000 of developing cancer as a result of consuming a specified amount of shellfish harvested from Boys Creek for the frequency and duration assumed in the risk evaluation.

B. Baseline Ecological Risk Assessment

The objective of the baseline ecological risk assessment was to identify and estimate the potential ecological impacts associated with the COCs at the Site. The assessment focused on the potential impacts of chemicals of concern found in the soils, surface waters, sediments and biological tissue to terrestrial and aquatic flora and fauna that inhabit or are potential inhabitants of the Site, which includes Boys Creek and the surrounding marsh area. The technical guidance for performance of the ecological risk assessment comes primarily from the following sources: "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (EPA, 1989); and "Risk Assessment Guidance for Superfund-Volume II, Environmental Evaluation Manual" (EPA, 1989b).

Risks were evaluated through the use of media-specific ecological effect levels, which are defined as the concentration of a particular contaminant in a particular medium below which no adverse effects to ecological receptors are likely to occur. Ecological effect levels were developed based on established numerical criteria (e.g., AWQC) or on information obtained from the literature (Long & Morgan, 1990 and 1991, and Long et al., 1995). These effect levels can be used to assess baseline risks to ecological receptors by comparing the effect levels to existing contaminant levels in the on-site media. In addition, toxicity testing with on-site sediments served to more fully define baseline risks to aquatic receptors.

Media that were investigated as part of this remedial investigation included surface water, groundwater, surface sediment, surface soil, fish and shellfish. Based on likely exposure pathways, as described in Section 6.4.1 of the RI (Weston, 1995), for species observed or expected to occur on Site, the following media and biota are of potential concern to ecological resources:

- Surface water and marsh soils throughout the Boys Creek Marsh,
- Surface water and sediments in the Boys Creek channel and its tributaries,
- Fish and shellfish within the Boys Creek channel and its tributaries, and
- Groundwater potentially discharging to Boys Creek Marsh and channel.

1. Identification of Chemicals of Concern

Tables I.3, I.6, I.7, I.9, I.11, and I.12 in the RI (Weston, 1995) list the chemicals detected in surface soils (0-2 feet), surface water, sediments, and shellfish samples collected within the Site study area. The chemicals of ecological concern for surface soils, surface water and surface sediments consisted of several organic and inorganic compounds. The chemicals of most concern in the soils were lead, endosulfan II, endosulfan sulfate, iron and copper. The chemicals of most concern in the surface water were arsenic, copper, cyanide, lead, mercury, nickel, and zinc. The chemicals of most concern in the sediments and shellfish were cyanide, arsenic, and iron.

2. Exposure Assessment

Within the exposure assessment, the potential exposure pathways for various species groups such as plants, benthic invertebrates, fish, mammals and birds were directly or indirectly evaluated to determine those considered to be at risk of significant exposure from site contaminants. Table 11 lists the exposure media, habitat types, receptors, exposure routes, and assessment and measurement endpoints for selected species groups for which a potential exposure risk has been identified and for which quantitative data exist. For this assessment, avian and mammalian species (e.g., black duck, great blue heron, and meadow vole) with the greatest potential for exposure were selected for a quantitative evaluation of exposure. The potential for biomagnification was evaluated by including receptors that typically ingest species for which tissue concentrations were assessed (e.g., fish and shellfish).

The meadow vole was assumed to be exposed to COCs through the ingestion of chemicals in soil and vegetation in the Boys Creek marsh. The black duck was assumed to be exposed to chemicals of potential concern through the ingestion of ribbed mussels and soft-shelled clams (site-specific data) exposed to the surface waters and sediments in Boys Creek. In addition, it was assumed that the black duck would incidentally ingest sediments during feeding. The great blue heron was assumed to be exposed to chemicals of potential concern through the ingestion of fish (site-specific data) that are exposed to the surface waters and sediments of Boys Creek.

3. Ecological Effects Assessment

Information on the toxicity of the chemicals of potential concern to ecological receptors was summarized in the toxicity assessment of the ecological risk assessment (Weston, 1997b). Species-specific toxicity data for the indicator avian and mammalian species (black duck, great blue heron and meadow vole) were not available for all of the chemicals of potential concern. Thus, toxicity values from the literature were selected using the most closely related species. Toxicity values selected for the assessment were the lowest exposure doses reported to be toxic or the highest doses associated with no adverse effect. Data for chronic toxicity were preferentially used, when available.

In addition, the toxicity of chemicals of potential concern to aquatic life was assessed by comparing average and maximum surface water concentrations in Boys Creek to marine acute and chronic AWQC, where available. The toxicity of the chemicals of potential concern identified in Boys Creek sediments to benthic and epibenthic organisms was evaluated by comparing sediment contaminant concentrations to the sediment biological effect ranges published by the National Oceanic and Atmospheric Administration [NOAA] (Long & Morgan, 1990 and 1991) and "Environmental Management" (Long et al., 1995) and by predicting the interstitial water contaminant concentrations through the use of the equilibrium partitioning approach and comparing those values to AWQC. Because of the potential synergistic effects of contaminants in sediments and the overall lack of existing sediment toxicity information in the literature, toxicity tests were conducted on sediment samples using the two aquatic invertebrates, *Hyalella azteca* (freshwater amphipod) and *Ampelisca abdita* (marine amphipod) at 25 locations within Boys Creek.

4. Ecological Risk Characterization

The mean mortality rates for each location and appropriate controls are presented in Figure 6.4.4 and 6.4.5 in the RI (Weston, 1995) for *A. abdita* and *H. azteca*, respectively. Mortality rates at sampling locations in the main stem of Boys Creek were evaluated in relation to grain size, total organic carbon, simultaneously extracted metals/acid volatile sulfide (SEM/AVS) ratio, metal concentrations, and organic chemical concentrations. In most cases, there were no clear or consistent correlations between these measured parameters and mortality. However, there did appear to be a correlation between nickel concentrations and *A. abdita* mortality. The SEM/AVS ratio also showed the same general trends. Other correlations also exist between grain size and mortality, and total organic carbon and mortality. In general, as grain size increased and organic carbon decreased, mortality increased. This may be the result of increased bioavailability of chemicals from sandy sediments with a lower organic carbon content. These trends were not consistent between tests or in the *H. azteca* tests. The lack of clear trends and consistent results is most likely a result of the interaction of a number of physical and chemical factors at each location.

The potential risk posed to ecological receptors (meadow vole, black duck, great blue heron, and benthic organisms) was evaluated by comparing estimated daily doses or medium-specific concentrations with critical toxicity values as shown in Table 6. This comparison, described as a Hazard Quotient (HQ) was made for each chemical. If the HQ exceeds unity (e.g., > 1) this indicates that the species may be at risk to an adverse effect from the chemical through the identified exposure route. Exposures to the same chemical through multiple exposure routes are considered to be cumulative and a cumulative Hazard Index (HI) was calculated to determine whether an organism could potentially be at risk due to exposure to all chemicals through all exposure routes.

For the meadow vole, the average and maximum HIs for the meadow vole are presented in Tables 6.4-21 and 6.4.22 in the RI (Weston, 1995), respectively. Lead, endosulfan II, endosulfan sulfate, iron and copper contributed to the majority of the cumulative HI based on their average concentration as shown in Table 6.

For the black duck, the average and maximum HIs are presented in Tables 6.4.23 and 6.4.24 in the RI (Weston 1995), and the three contaminants contributing to the majority of the cumulative HI were cyanide, iron and arsenic based on their average concentrations as shown in Table 6.

For the great blue heron, Table 6.4.25 in the RI (Weston, 1995) presents the average and maximum HIs. Cyanide is responsible for contributing to the greatest percentage of the cumulative HI based on its average concentration as shown in Table 6.

Based on the two surface water sampling rounds that were conducted during the RI, several average and maximum contaminant concentrations were identified that had HQs greater than unity. Results of the August 1991 sampling round indicate arsenic, copper, cyanide, lead, mercury, nickel, silver and zinc concentrations exceeded AWQC. In April 1992, copper, mercury, and zinc exceeded chronic AWQC at both mean and maximum concentrations. Thus, there is a risk to aquatic organisms in the surface waters from exposure to these chemicals of ecological concern.

Table 6.4.20 in the RI (Weston, 1995) represents the comparison of average and maximum sediment concentrations against the sediment biological effect ranges published by NOAA (Long & Morgan, 1990 and 1991) and "Environmental Management" (Long et al., 1995) or marine chronic AWQC. The average HI exceeded one for all chemicals with the exception of chromium. The chemicals with the highest maximum HQs were: methoxyclor, DDE, copper, DDD, DDT, endosulfan, cadmium, zinc and nickel as shown on Table 6. The risk to aquatic organisms is confirmed by results from the sediment toxicity testing, which indicated that the exposure to chemicals in sediments was responsible for a decrease in survival at the majority of sampling locations north of the hurricane barrier.

The ecological risk assessment is subject to some uncertainties. For example, in the exposure assessment, assumptions were made in order to estimate daily intakes for the indicator species, the meadow vole, black duck, and great blue heron. Since limited site-specific information was available, assumptions were made regarding ingestion rates, frequency of exposure, and exposure point locations. Conservative, yet realistic assumptions were made in the absence of site-specific information. The reader is referred to Section 6.4.3.4 of the RI (Weston, 1995) for a discussion of the primary uncertainties associated with the risk evaluation for each of the indicator species.

In summary, contaminant levels in soils and sediments throughout Boys Creek and the surrounding marsh area (including the tidal creek proper and the tidal marsh surface) and adjacent upland areas are sufficiently elevated to pose a substantial risk to invertebrates, fish and wildlife through direct contact and dietary exposure to a variety of organic chemicals and metals.

C. Overall Risk Assessment Conclusion

The human health risk assessment identified unacceptable risks posed by soils in the Commercial Area to maintenance workers and a potentially significant risk to consumers of shellfish in Boys Creek. The ecological risk assessment identified unacceptable risks posed by soils, sediments, surface water, and biota throughout the Site to invertebrates, fish, and wildlife. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment. As such, surface soils 0-2 feet in depth in the Commercial Area and sediments in Boys Creek will be the focus of the remedial action necessary to protect human health, while soils, sediments, and groundwater throughout the Site will be the focus of the remedial action necessary to protect invertebrates, fish, and wildlife.

Results of the baseline human health risk assessment identified concentrations of arsenic, benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h] anthracene, indeno[1,2,3-cd]pyrene, 3,3'-dichlorobenzidene, PCB (Arochlor-1260), and lead in soils and sediments in the Commercial Area and Boys Creek that are present at levels which represent unacceptable carcinogenic and noncarcinogenic risks.

Results of the baseline ecological risk assessment identified maximum concentrations of copper, lead, mercury, nickel, silver, zinc and cyanide in surface waters throughout the Site that frequently exceeded criteria levels. Thus, there is a risk to aquatic organisms in the surface waters and associated wetlands from exposure to these chemicals of ecological concern. Concentrations of endosulfan sulfate, anthracene, DDT (total), cadmium, copper, cyanide, lead and zinc were identified as representing the greatest risk to the survival, reproduction and growth of the benthic community. The risk to the benthic community is confirmed by results from the sediment toxicity testing, which indicated an increase in mortality at locations north of the hurricane barrier where contaminants of concern were elevated. Through direct consumption of marsh vegetation and incidental ingestion, the meadow vole is potentially at risk from exposure to several compounds. The chemicals contributing the greatest risk are endosulfan II, endosulfan sulfate, iron, and lead. The exposure pathway responsible for risk to the black duck is the ingestion of benthic fauna and incidental sediment ingestion. Arsenic and cyanide are the major contaminants of concern contributing to the risk to the black duck and great blue heron, through the ingestion of contaminated fish.

VIII. Development and Screening of Alternatives

A. Statutory Requirements and Remedial Action Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) establishes several other statutory requirements and preferences, including: a) a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; b) a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and c) a preference for remedies in which treatment permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances as principal element over remedies not involving such treatment. The response alternatives were developed to be consistent with these Congressional mandates at this Site.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to public health and the environment.

The remedial action objectives were:

1. Attain Commercial Area surface (0 to 2 feet) soil/sludge contaminant concentrations which are protective of human health, assuming commercial exposure for human receptors.

2. Attain Solid Waste and Debris Area surface (0 to 2 feet) soil and sediment contaminant concentrations which are protective of aquatic and terrestrial organisms.

3. Attain Marsh and Creek Bed Area surface (0 to 2 feet) soil and sediment contaminant concentrations which are protective of human health (shellfish ingestion) and aquatic and terrestrial organisms.

4. Attain surface water contaminant concentrations which are protective of human health and aquatic and terrestrial receptors.

5. Protect surface water and sediments from contaminant migration from Commercial Area, Solid Waste and Debris Area, and Marsh and Creek Bed Area soils and sediments.

6. Prevent unacceptable risk to humans due to exposure to contaminants that may migrate from the groundwater via vapor intrusion into buildings.

7. Protect the surface water in Boys Creek and its tributaries from contaminant migration from groundwater.

8. Comply with applicable chemical-, location-, and action-specific ARARs.

B. Alternative and Technology Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements and the remedial action objectives listed above, a range of cleanup alternatives was developed for the Site.

With respect to source control, the FS developed a range of alternatives in which, for some alternatives, treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long term management. This range also included alternatives that treat the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

With respect to groundwater response action, the FS developed a limited number of remedial alternatives that attain site specific remediation levels within different time frames using different technologies; and a no action alternative.

As discussed in Chapter 3 of the FS, the FS identified, assessed and screened technologies based on implementability, effectiveness, and cost. These technologies were combined into source control (SC) and management of migration (MM) alternatives. Chapter 4 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e) (3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened in Chapter 5 of the FS.

In summary, of the 23 source control and 4 management of migration remedial alternatives screened in Chapter 4 of the FS, 13 source control alternatives and two management of migration alternatives, and a composite No-Action alternative were retained for detailed analysis. Tables 3-1 to 3-5 of the FS (Weston , 1998b) identify the 16 alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

IX. Description of Alternatives

This section includes each remedial alternative evaluated in detail for the FS and considered during the remedy selection process. Sixteen cleanup alternatives, including a composite No-Action alternative, were evaluated in detail for the various areas: Commercial (CA), Solid Waste and Debris (SWD), Marsh Surface Soil (MSS), and Creek Bed Sediment (CBS) Areas; and Groundwater (GW). Similar source control alternatives for the different areas were combined in the Proposed Plan to simplify the cleanup selection process. The cleanup alternatives are different combinations of plans to remove, contain, or treat contamination. This section summarizes the cleanup alternatives presented in the Proposed Plan and applies a number to each alternative for ease of reference. In the Proposed Plan, EPA identified Alternative 4 (Source Removal with Treatment and On-Site Disposal) and Alternative 6 (Minimal Action Groundwater - Monitored Natural Attenuation with Phytoremediation) together as the preferred alternatives. Please consult the FS for more detailed information on the individual alternatives for each area.

Alternative 1. No Further Action (NA-1): This alternative is a combination of all the No-Action Alternatives (CA-1, SWD-1, MSS-1, CBS-1 and GW-1) for the different source areas and groundwater. This alternative involves no treatment or containment of contaminated soils, sediments, and groundwater at the Site. The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the Site in its present state. The No-Action Alternative is required to be evaluated as a baseline against which all other alternatives are compared. This alternative would not be protective of human health and the environment.

Click here to go to Part 2 of Decision Summary